Procurement and Property Management Division

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for the U.S. Department of Energy

www.bnl.gov

April 14, 2009

Reference: I.F.B. No. CCWF-II
Central Chilled Water Facility – Phase II

Subject: Amendment No. 2 to I.F.B. No. CCWF-II

Dear Sirs/Madams:

Amendment No. 2 to the subject I.F.B. is issued to modify this solicitation as follows:

1. Addendum No. 2 to Specifications and Drawings to CCWF-II dated 04/13/09 is attached hereto and made a part hereof. It described changes to the drawings and specifications which are located at www.bnl.gov/pe/CCWF. It also contains the Pre-Bid Meeting attendance sheet.

2. The following was discussed at the Pre-Bid Meeting:

   A. This project will be partially funded by the American Recovery and Reinvestment Act (ARRA). This will impose some reporting requirements to approximately 75% of the award amount. More information concerning this will be forth coming in a future Amendment.

   B. Bidders were advised that they should read all contract documents (not just the drawings and specifications) in order to capture all costs associated with working at BNL. It would also be helpful to converse with other contractors who have experience working at BNL.

The bid submission date remains April 24, 2009 at 3:00 P.M. Bids will be open IN PRIVATE.

Please acknowledge Amendment No. 2 on the I.F.B. "Bid" page (page 3 of 6) on both copies that you will submit. Failure to acknowledge Amendment No. 2 may result in you bid being considered non-responsive.

Very truly yours,

Philip Gardner
Sr. Contracts Specialist

Attachment:
Addendum No. 2 dated 04/13/09

ln#g

BROOKHAVEN
NATIONAL LABORATORY

Facilities and Operations
Modernization Project Office
Building 134C
P.O. Box 5000
Upton, NY 11973-5000

Date: 04/13/09

ADDENDUM NO. 2

to

SPECIFICATIONS AND DRAWINGS

For

Central Chilled Water Facility – Phase II

BNL Job. No. 11705

GENERAL: This Addendum is to amend Drawings and Specifications dated February 19, 2009 issued with the Bid Documents.

Material, work, and workmanship, except where specified otherwise in this Addendum, shall conform to all requirements of Contract Documents and become a part thereof.

Central Chilled Water Facility II
Addendum #2

A pre-bid meeting was held on 4/4/09. The list of attendees is attached for reference.

Specification Changes

1. Specification Sections 02057, 02300, 02740, 03300, 03315, 05120, and 13125: Delete all references to Owner testing agencies for field quality control. Contractor shall retain qualified testing agencies for soils, asphalt, steel, and concrete testing.
2. Section 02300: Add Paragraph 1.2 D "Submit a detailed Excavation Plan indicating slopes of excavation, locations of shoring/ sheeting, and methods of protecting utilities. Coordinate with submittals for Section 02300A."
3. Section 02300: Delete Section 3.2.D, "Method of Payment".
4. Section 02300: Add paragraph 3.3.B.3, "Trees and stumps that have been chipped or ground may be recycled at BNL's compost area approximately one mile away. Trees or stumps which are not chipped or ground shall be legally recycled or disposed of off the BNL site."
5. Section 02300: Add paragraph 3.3.B.4, "Clean fill consisting of concrete and other masonry solid waste (including steel and fiberglass reinforcing rod that are embedded in concrete), asphalt pavement, sand, dirt, soil, brick, and stone that is not contaminated with spills of petroleum product, hazardous, or industrial waste may be deposited for recycling on the BNL site approximately one mile away."
6. Add Section 02300A, "Excavation Support and Protection" (attached).
7. Add Section 07412 "Metal Siding" (attached). This section applies to the extension of Building 600.
8. Section 08710: Add Paragraph 2.5.D: "Locks and cores shall be as follows:

    1. All locks and cylinders shall be manufactured by Best Lock Corporation, complete with 1C7A1 x US4 x US26D uncombinated cores. No substitutions will be accepted. Place all orders with Best Lock Corporation, RD 2 Fields Lane, North Salem, New York 10560, specifying that the material is for Brookhaven National Laboratory and that all packages, shipping tickets and correspondence have the following identification information prominently printed thereon:

    "For installation in Bldg. 600, Job No.11705"

2. Upon receipt of uncombinated cores, exchange same for "Contractor Cores" and keys from MPO, and install "Contractor Cores" in all locks. At job completion, return all keys properly tagged to MPO. MPO will then have "Contractor Cores" removed and replace with final cores.

9. Section 13125, Paragraph 1.1.A.1: Add "All buildings in this contract are to have similar exterior siding of type, color and profile to match existing buildings."
10. Section 13125, Paragraph 1.1.A.4.a: Delete "(exposed blanket insulation)". All siding shall have interior metal liner panels.
11. Section 13125, Paragraph 2.2.C: Delete all references to "exposed" fasteners. Replace with "concealed" fasteners.
12. Section 15300, Paragraph 3.8.B: Add Paragraph "4. Hydrostatic test piping to 200 psi for two hours. Complete BNL Sprinkler System Material and Test Certificate."
13. Section 15710, Delete "2.2.D.1.a Leslie", Delete "2.2.F.3.b TLV", Delete "2.3.A.3.a Domestic Pump" and "2.3.A.3.b Roth Pump".
14. Section 15710, Add "2.3.A.3.a "Air Flow Pump" and "2.3.A.3.b Federal".
15. Section 15770, Paragraph 3.1.B.1, Delete "under other contracts".
16. Section 16100, Change paragraph 2.1.A.1 to Rockwell Automation Allen-Bradley Bulletin 2100

Item	Allen Bradley Part. No.
MCC-600A-2	01399914/1
MCC-600-3	01399916/1
MCC-600-4	01399917/1

17. Section 16100 Paragraph 2.2.F, Add:

Variable Frequency Drives (Allen Bradley)

CHWP (Chilled Water Pumps)

Allen Bradley Part Number:

21CD385BPCANNBCB0NNNN-HD-B1X-ACDT-C1-DCDT-J2-J4-P4-P11-PB4M3RF3-S1-S9-S10-S13-S14-S18

CWP (Condenser Water Pumps)

Allen Bradley Part Number:

21CD261BPCANNBCB0NNNN-HD-B1X-ACDT-C1-DCDT-J2-J4-P4-P11-PB4M3RF3-S1-S9-S10-S13-S14-S18

Cooling Tower Fans

Allen Bradley Part Number:

21BD156ACANNACD0NNNN-HD-B1X-ACDT-C1-DCDT-J2-J4-L1-P4-P11-PB4M3RF3-S1-S9-S10-S13-S14-S18

18. Section 16320, Part 1.2.B: Change "Bid Data" to "General Data". Change B.1 to "Submit the following information with shop drawings:"
19. Add Section 16350A, "Short Circuit/Coordination/Arc Flash Study" (attached).
20. Section 16400, Part 3, Paragraph 3.1.F.2: Replace with "Owner will provide arc flash analysis results and BNL standard arc flash labels. Install labels on equipment in accordance with analysis provided prior to startup."
21. Section 16721, Paragraph 1.1.A, Add "BNL and manufacturer's representative will make final connections, program, and test the fire control panel with Contractor's personnel available for corrections or changes."
22. Section 16721, Paragraph 1.2.F.1, Change Class "A" to "B".
23. Section 16721, Delete 1.2.F.4.
24. Section 16721, Paragraph 1.10.A, Change the NEMA 12 enclosure to blue.
25. Section 16721, Add "1.13.A.2.p Fire Code of New York State".
26. Section 16721, Add "1.13.B.3.p Record of Completion Form (BNL Standard based on NFPA 4.5.1.3)
27. Section 16721, Paragraph 1.14.C, Change 80 hours to 8 hours.
28. Section 16721, Delete Section 1.17.
29. Section 16721, Add "1.19.A.9 Notify BNL Fire Department."
30. Section 16721, Paragraph 2.1.A, Delete "with the bid".
31. Section 16721, Paragraph 2.1.C.1, Add "w/voice, Contact Paul Sanfilippo, Northeast Regional Sales, Levittown, NY, 11756 Tel. 516-796-6121.
32. Section 16721, Paragraph 2.1.E.1, Only Photoelectric detectors shall be used.
33. Section 16721, Paragraph 2.1.F, Photoelectric detectors shall be addressable with 2 wire. Auxiliary relay is not required.
34. Section 16721, Paragraph 2.1.G, Speakers wattage as required.
35. Section 1671, Replace Paragraph 2.1.K with "Non- addressable devices shall have their end of line resistors clearly marked on the drawings and in the field."
36. Section 16721, Add Paragraph 3.1.D, "BNL and Manufacturer's representative shall make final terminations to the FACP. Contractor to mount FACP back box with wire trough above, run all conduit and cable to 6"x6" wire trough and leave 15' coils. Run 2" (minimum) nipples down to FACP back box."

37. Section 16721, Replace Paragraph 3.3.D with, "Submit BNL Record of Completion form (based on NFPA 4.5.1.3)."

38. Section 16721, Paragraph 3.4.A, Delete the last sentence.

Drawing Changes

1. Addendum 1 contained incorrect drawing numbers. The work indicated on the following drawing(s) is hereby no longer part of this contract:

   Dwg. No. M-630-10
   Dwg. No. M-630-13
   Dwg. No. M-630-16
   Dwg. No. M-630-17
   Dwg. No. M-630-18
   Dwg. No. M-630-23
   Dwg. No. M-630-24

   The working indicated on the following drawings as "Provision, Installation and configuration by others" is completed, and consequently not part of this contract.

   Dwg. No. M-630-03
   Dwg. No. M-630-19

2. A revision is made to the electrical substation, switchgear, feeders and relays within the 13.8kV and 4.16kV systems. This consists primarily of:
   a. Addition of a second 13.8kV/4.16kV transformer and associated grounding resistor.
   b. Addition of 13.8 kV fused switchgear lineup (Substation 600B) in lieu of 13.8 kV breakers.
   c. Additional compartments to Substation 600B in order to accommodate 13.8 kV/4.16 kV 7500 kVA transformers #3 and #4.
   d. Addition of cables, ductbank and manhole from load side of 7500 kVA transformer #4 to new Building 600 extension.
   e. Addition of cables and associated conduit from existing Substation 600A to new Substation 600B.
   f. Modification of new Swgr. 600-2 Expansion to include:
      1) Six (6) Fused Full Voltage starters with Multilin 469 motor management relays in lieu of breakers.
      2) Two (2) vacuum breakers feeding the 2500 kVA transformers in lieu of fused switches.
      3) Additional Capacitor Bank to accommodate incoming feed from Transformer #4.

g. Expansion of the substation pads, masonry walls, perimeter curb, grounding, and fencing to accommodate the added equipment.

h. Deletion of the duct bank and cables from Substation 661A to Substation 600B across Rochester Street.

i. Increase conduit size in ductbank from substation 600B to Building 600 extension. (5" conduits)

j. Addition of four (4)- five (5) inch spare conduits from Substation 600 B compartments 4B and 5B to area just outside fenced area for future use.

k. Deletion of Kirk key interlock system at 4,160V level.

l. Modify short circuit rating of MCC-600-3, MCC-600-4, and MCC -600-2 from 42 kA to 100 kA.

m. Addition of solid state circuit breaker with an L-S-I trip unit in panel DP-2 that serves the 45 kVA transformer.

n. Deletion of two (2) reduced voltage auto transformer starters for Chillers CHL-5 and CHL-6.

o. Removal of allocated physical space for deletion of five (5) reduced auto transformer starters (CHL-5, CHL-6 and future chillers CHL-7, CHL-8, CHL-9).

This change affects the following drawings (included in this addendum):

- CE-03, Rev. 1
- CE-05, Rev. 1
- E-601, Rev. 1
- E-602, Rev. 1
- E-610, Rev. 1
- EP-102, Rev. 1
- EP-301, Rev. 1
- EP-302, Rev. 1
- EP-402, Rev. 1
- ES-101, Rev. 1
- ES-402, Rev. 1
- ES-403, Rev. 1

3. Add 24" x 24" Tee with valve and blind flange to the 24" CWS header in pipe tunnel. Tee is shown on the flow diagram (Dwg. MP-603). It must be added to the piping shown on Drawings MP-100 and MP-302. Exact location will be determined during construction.

Attachments

- Pre-bid meeting attendee list
- New specification sections
- Revised drawings

BNL CCWF II
Addendum 2
Pre-bid Meeting Attendee List

PRE-BID MEETING

PROJECT: **Central Chilled Water Facility**

PLEASE PRINT

IFB: NUMBER: CCWF-II JOB NUMBER: 11705 DATE: April 7, 2009

NAME	COMPANY (Name, Phone & email address)
Phil Gardner	BNL PPM 344-5475 gardnep@BNL.GOV
[illegible]	BNL
Mark Toscano	BNL/EU
TOM JOOS	BNL/LT 344-7707 joos@bnl.g
John Buck	HINCK ELECTRIC 277-7700
Robert Linsky	IBEX Construction 646-366 6220 718-340-1426
VINCENT TERRAFERMA	tesw Mechanical Svcs. Vterraferma@tesww.com
Howard Dunshee	Bartco Mechanical Corp.
MARK TOMANELLI	HERITAGE MECHANICAL CORP.
Mike Gennuso	Fortunato Sons Contr. Co.
Frank Timmons	~~Northg~~ Rockmore Contr. Corp.
JOE PAWZECKA	NORTHGATE ELECTRIC.
Dante Herron	AB 973-303-0582 dmherron@rockwell.com

PRE-BID MEETING

PROJECT: **Central Chilled Water Facility**

PLEASE PRINT

IFB: NUMBER: CCWF-II JOB NUMBER: 11705 DATE: April 7, 2009

NAME	COMPANY (Name, Phone & email address)
MESHULAM KLEINER	BP MECHANICAL (718) 387-2100 MKLEINER@BPAIR.COM
TODD WILLIAMS	AALCO RIGGING (516) 644-1221 todd@aalco.net
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Evelyn Landini	DOE-BHSO x7812
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Peter McGlade	Mid-Island Electric
Sheri Alexander	PPM
Mario Fallier	NSLS-II
John Cosman	NSLS II
FRED LIMERT	TRANE CO. 718-269-3772 fdlimert@trane.com
Alan Raphael	BNL
Scott Fertig	Applied Energy Management

PRE-BID MEETING

PROJECT: **Central Chilled Water Facility**

PLEASE PRINT

IFB: NUMBER: CCWF-II JOB NUMBER: 11705 DATE: April 7, 2009

NAME	COMPANY (Name, Phone & email address)
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Mike DuBois	PPM
Mike McGrath	PPM
Ed Murphy	EW
Bob McKay Bob	MCF.
MICHAEL RISTA	TORCON, INC.
BILL CHALOUPKA	BNL - OPS HEAV
GARY HIDA	HIDAG@ACE-NET.COM Applied Control Engineering.
Alan Rychael	BNL/MPO

BNL CCWF II
Addendum 2
New Specification Sections

SECTION 02300A

EXCAVATION SUPPORT AND PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, professional services, and accessories for temporary excavation support and protection work.

B. Related Work In Other Sections
   1. Coordinate this work with SECTION 02300 - EARTHWORK.

1.2 CODES AND STANDARDS:

A. OSHA 29 CFR 1926.

B. BNL Standards-Based Management System; ES&H Standards (SBMS).

C. American Society for Testing and Materials.

D. National Electric Code.

1.3 PERFORMANCE REQUIREMENTS:

A. Design, provide, monitor, and maintain an anchored and braced excavation support and protection system capable of resisting soil and hydrostatic pressure and superimposed construction loads, and supporting sidewalls of excavations.
   1. Provide professional engineering services needed to assure engineering responsibility.
   2. Work includes removing excavation support and protection systems when no longer needed.
   3. Prevent surface water from entering excavations by grading, dikes, or other means.
   4. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.
   5. Supervision shall be provided by the support and protection contractor's "Competent Person" as defined in 29 CFR 1926.650.
   6. No excavation support work may proceed until MPO issues the proper Digging Permit.

1.4 SUBMITTALS:

A. Shop Drawings:
   1. Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems. System design, calculations, and comprehensive engineering analysis must be acceptable to MPO.

2. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data:
1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Photographs or Videotape:
1. Sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by excavation support and protection systems.

1.5 QUALITY ASSURANCE:

A. Installer Qualifications:
1. Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing excavation support and protection systems similar to those required for this Project and with a record of successful in-service performance.

B. Professional Engineer Qualifications:
1. A professional engineer who is legally qualified to practice in the State of New York and who is experienced in providing engineering services for designing excavation support and protection systems that are similar to those indicated for this Project in material, design, and extent.
2. Engineering Responsibility:
a. Engage a qualified professional engineer to prepare or supervise the preparation of data for the excavation support and protection system including drawings and comprehensive engineering analysis that shows the system's compliance with specified requirements.

1.6 PROJECT CONDITIONS:

A. Existing Utilities:
1. Do not interrupt utilities serving facilities occupied by BNL or others unless permitted in writing by MPO, and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project Site Information:
1. A geotechnical report has been prepared for this Project and is available for information only. The report is not part of the Contract Documents. The opinions expressed in this report are those of the geotechnical engineer and represent interpretations of the subsoil conditions, tests, and results of analyses conducted by the geotechnical engineer. BNL will not be responsible for interpretations or conclusions drawn from this data by Contractor.
2. Make additional test borings and conduct other exploratory operations as necessary.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
   1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify MPO if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 PRODUCTS:

2.1 MATERIALS

A. Materials need not be new but must be in serviceable condition.

B. Structural Steel: ASTM A 36 (ASTM A 36M).

C. Steel Sheet Piling: ASTM A 328 (ASTM A 328M) or ASTM A 572 (ASTM A 572M), with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 3 inches (75 mm).

PART 3 EXECUTION:

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
   1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from MPO. Provide alternate routes around closed or obstructed traffic ways where required.

C. If system location is in areas of overhead electric lines, clearance requirements shall be as defined in Article 100 of the National Electric Code.

D. Locate excavation support and protection systems clear of permanent construction and to permit forming and finishing of concrete surfaces.

E. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure excavation support and protection systems remain stable.

F. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER BEAMS AND LAGGING:

A. Install steel soldier piles before starting excavation. Space soldier piles at intervals indicated. Accurately align exposed faces of flanges to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at centers indicated and secure to soldier piles.

3.3 SHEET PILING:

A. Install one-piece sheet piling and tightly interlock to form a continuous barrier. Accurately align exposed faces of sheet piling to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS:

A. Drill for, install, tension, and grout tiebacks into position. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

3.5 BRACING:

A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing before removing original brace.
   1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by BNL.
   2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
   3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS:

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and damaging structures, pavements, facilities, and utilities.
   1. Repair or replace, as approved by MPO, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Only leave excavation support and protection systems permanently in place when specifically approved by BNL.

END OF SECTION

Revision History	
Date	**Rev. No.**
04-08-09	0

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SECTION 07412

PREFORMED METAL SIDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes
   1. Insulated Metal Siding: Provide nominal 3-1/2 inch thick fluted-profile field-assembled thermal-insulated metal siding to the extent shown.
   2. Provide siding in maximum lengths practicable to eliminate or minimize the number of end laps. For walls 30 feet or less in height, provide metal siding in full 1-piece continuous lengths without end laps. For walls over 30 feet in height where end laps are approved, provide die-set ends on sheets for flush overlap.
   3. All siding for this project, including exterior sheets, liner panels, subgirts, flashings, copings, trim members, closures, fasteners and other required items, shall be provided by a single manufacturer.

B. Related Work Specified in Other Sections
   1. Structural steel building framing - Division 5.
   2. Miscellaneous metal fabrications - Division 5.
   3. Flashing and Sheet Metal – Division 7.
   4. Sealant and calking of joints at perimeter of preformed metal siding abutting other construction – Division 7.
   5. Decorative painting of preformed metal siding on the interior of the building - Division 9.
   6. Pre-engineered Building – Division 13.

C. Related Work Performed Under Other Contracts
   1. Structural steel building framing – Structural Steel Contract

1.2 PERFORMANCE REQUIREMENTS

A. Design Criteria
   1. Provide metal siding having maximum deflection of 1/120 of clear span, per AISI "Specifications for the Design of Light Gage Cold-Formed Steel Structural Members" based on resistance to inward wind pressure and outward suction pressure of not less 20 psf, unless greater wind load value is noted on Drawings.
   2. When tested in test chamber of size to accommodate panels equal in height to maximum clear span and approximately 12 feet wide, at each application of pressure for a series of 6 such applications for each test, based on exterior siding sheet, siding shall conform to the following:
      a. Air Infiltration, per ASTM E 283. Maximum 0.02 cfm per square foot of wall area at air pressure difference of 1.57 lbf/psf.

b. Water Penetration per ASTM E 331. No visual evidence of water penetration per AAMA 501-83, at air pressure difference of 20% of positive design wind pressure with a minimum of 6.24 lbf/psf.

3. For steel sheet, wherever a specific gage is specified in this Section, followed by a minimum thickness in inches, the minimum inch thickness shall govern, based on bare, uncoated sheet. There shall be no tolerance under the specified minimum inch thickness.

1.3 SUBMITTALS

A. Furnish submittals for items that are identified in this Section by a different typeface and a bracketed code (e.g., *Item [L]*). Refer to Division 1 General Requirements for definition of codes for types of submittals and the administrative requirements governing submittal procedure. General submittal requirements pertaining to this Section are specified herein under this Article.

B. Prepare and submit completely detailed Shop Drawings. Show completely dimensioned structural frame and erection layouts, openings in walls, any special framing details, details at corners, building intersections, expansion joints, trim, and flashing. Also indicate materials, gage or thickness, profiles, widths, lengths, special cuts, locations and types of flexible and metal closures, location and erection of subgirts, typical location and type of fasteners, and information necessary for adjacent work.

C. Submit, attesting that pressure-release fasteners are designed to fail at pressure specified and that fasteners are FM Approved and Listed.

D. *Structural Calculations [C]*: Submit structural calculations for preformed metal siding system certifying to its conformance to the design criteria. Calculations and certification shall be prepared by a structural engineer licenses in the State of New York.

1.4 QUALITY ASSURANCE

A. Requirements Of Regulatory Agencies
   1. Use materials and methods of installation to produce installed siding that complies with wind load requirements of governmental authorities having jurisdiction, unless different requirements are noted on the Structural Drawings or specified herein.
   2. Use FM Approved and Tested fasteners for securement of siding in areas designated or noted as "pressure-release siding" or "blow-out panels".

B. Installer Qualifications: The Work of this Section shall be carried out by an approved installer having specialized in this Work as its primary business for at least 5 years and having performed satisfactorily Work of this type and scope.

C. Engineer Qualifications: Verification of preformed metal siding systems by a professional engineer licensed in the area of jurisdiction where the project is located and experienced in product systems specified.

D. ULI classification for use as a component of a non-load bearing metal siding system per ASTM E 119 and indicated by designations in the UL "Fire Resistance Directory"

E. Provide data from a qualified testing agency of criteria specified in the previous article "Performance Requirements".

F. Mockups:
   1. At the beginning of the work for each particular type of application, the Contractor shall install the approved metal siding system to a sample area to enable the Owner's Representative to inspect the Contractor's methods of installation, workmanship and finished work. The sample areas will be designated by the Owner's Representative, but will not be less than 50 square feet. Work is to be continued only after the Contractor has received written approval of the inspected sample areas from the Owner's Representative. All subsequent work shall conform to the approved sample areas in every respect.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store units at the site off the ground and in proper sequence to expedite installation.

B. Bundles or stacks of metal sheets shall not exhibit any form of sticking between sheets. Apply manufacturer's standard anti-stick process, or any other suitable system to assure compliance with this anti-stick requirement. Use anti-stick compound or ply that is readily removable and does not adversely affect the finished surfaces.

1.6 WARRANTIES

A. General Warranty: Special warranties specified below shall not negate the Owner's right that the Owner may have under prevailing local laws, or any other requirements of the Contract Documents. The special warranties specified below are in addition to other warranties and are concurrently applicable to other warranties made by the contractor by other requirements of the Contract Documents.

B. Polyvinylidene Fluoride Finish Warranty: Furnish to the Owner in an approved form, warranting the polyvinylidene fluoride finish will be nonfacing, nonconvertible, nonchalking, nonblistering, noncracking and permanently a part of the metal surface for a period of twenty years after acceptance of the building. State in the guarantee that any items showing failure during the guarantee period will be replaced or refinished to the original condition, at no cost to the Owner.

PART 2 PRODUCTS

2.1 INSULATED METAL SIDING

A. System
   1. *Insulated Metal Siding [D]:* Provide field-assembled system having an overall nominal thickness of 3-1/2 inches, consisting of 1-1/2 inch deep interior liner panel, 1-1/2 inch

thick thermal insulation, metal subgirts, and 1-1/2 inch deep profiled exterior siding sheet, complete with closures and metal trim.

B. Exterior Siding Sheet
   1. Metal and Gage:
      a. Galvanized steel sheet, minimum 20 gage, design thickness .0358 inch, minimum thickness .034 inch (before any embossing and coating), formed to profile specified.
      b. Aluminum sheet, minimum .050 inch thick (before embossing and coating), formed to profile specified.
   2. Finish on Exterior Side of Exterior Sheet:
      a. Polyvinylidene Fluoride Finish as specified.
   3. Finish on Interior Side of Exterior Sheet:
      a. Prime Paint Finish as specified.
   4. Exterior Sheet Profile: 1-1/2 inch deep, 12 inch wide, concealed-fastener type.
      a. Centria IW-21A, or other approved manufacturer to match existing building exterior panel profile.

C. Interior Liner Panel
   1. Metal and Gage:
      a. Galvanized steel sheet, minimum 20 gage, design thickness .0358 inch, minimum thickness .034 inch (before any embossing and coating), stucco embossing optional, formed to profile specified.
   2. Finish on Exposed Side of Liner Panel:
      a. Polyester Paint Finish as specified.
   3. Finish on Concealed Side of Liner Panel:
      a. Prime Paint (polyester paint) Finish as specified.
   4. Liner Profile: 1-1/2 inch deep, 24 inch wide panels with flat unperforated face, with male and female interlocking nesting edges, female edge factory-calked, of same manufacturer as the exterior siding sheet:
      a. Centria L-2V or V-Liner 24, or other approved manufacturer to match existing building liner panel.

2.2 MATERIALS

A. Galvanized Steel Sheet: Structural quality per ASTM A 653, Grade 37 minimum, hot-dipped galvanized per ASTM A 924.

B. Aluminum Sheet: Aluminum Association "Alclad" 3003H154 alloy, per ASTM B 209, with stucco-embossed surface.

C. Sub-Girts: Minimum 16 gage steel sheet per ASTM A 653, hot-dipped galvanized to Coating Designation G-90, Minimized Spangle and Chemically treated, formed to hat-shape sections or other shapes as standard with siding manufacturer.

D. Angle Closures: ASTM A 36 steel, hot-dipped galvanized per ASTM A 653 to Coating Designation G-90, Minimized Spangle and Chemically treated, of section sizes and weights to meet project requirements.

E. Fasteners: Use manufacturer's standard items, but conforming to the following minimum requirements:
   1. Exposed Fasteners: Type 305 stainless steel shank, self-drilling or self-drilling and tapping sheet metal screws with stainless steel and neoprene washer, and plastic-coated hex-head or separate head cap to match color of siding. Use 3/4" long for flashings and accessories, 1" or longer as required for siding sheets. Use neoprene washer of 1/32" to 1/16" thick, Shore A durometer of 60 to 90 and with anti-oxident additive.
   2. Concealed Fasteners: No. 14 x 1", minimum, cadmium-plated steel self-tapping screws.

F. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

G. Joint Sealing Material:
   1. Sealant Tape: Pressure-sensitive, 100% solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1.2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
   2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
   3. For field-sealed joints, use sealant as specified in Sealants And Calking, Division 7.

H. Thermal Insulation: Un-faced semi-rigid glass fiber insulation Type 1 per ASTM C665, incombustible type with a flame spread rating of 25 or less per ASTM E 84, of same width as liner panel, minimum 1-1/2 inch thick and minimum 1.65 pcf density, to achieve a U-factor thermal insulating value of 0.15 or better.

I. Protective Coatings:
   1. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4 mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

J. Provide siding with factory applied strippable film.

2.3 FINISHES

A. Prime Paint Finish
   1. Baked-on Rust-inhibitive Prime Paint: Siding manufacturer's standard finish not less than 0.5 mil dry film thickness (0.2 mil prime and 0.3 mil finish) each side suitable for field painting.
      a. Provide manufacturer's standard primer color.
      b. Except color on exposed surfaces shall be "off-white".
   2. Finish shall meet the following performance requirements:
      a. *Salt Spray Test [T]:* When subjected to a salt fog spray test per ASTM B 117 for 250 hours, blistering shall not exceed 5% No. 6 blisters in the field (ASTM D 1654). No more than 1/16" creep corrosion and tape off from area scribed to base metal.

B. Baked Enamel Finish
   1. *Baked Enamel Finish [S]:* Siding manufacturers standard finish system, consisting of cleaning, conversion coating, prime coating, and finish coating, with minimum total dry film thickness of 1.0 mil (0.2 mil primer and 0.8 mil finish). Oven-cure prime coat prior to finish coat application. Provide finish coat of acrylic polyester or silicone polyester or equivalent polyester resin coating, factory-applied and oven-cured.
      a. Provide color to match existing building, per approved samples.
   2. Finish shall meet the following performance requirements:
      a. *Salt Spray Test [T]:* When subjected to a salt spray (fog) test performed per ASTM B 117 for 500 hours, blistering shall not exceed 5% No. 6 blisters in the field (ASTM D 1654). No more than 1/16" creep corrosion and tape off from area scribed to base metal.

C. Polyvinylidene Fluoride Finish (Kynar)
   1. *Polyvinylidene Fluoride Finish (Kynar) [S]:* Baked resin finish system to match existing building siding color, consisting of cleaning, conversion coating, prime coating, and finish coating, with minimum total dry film thickness of 1.0 mil (0.2 mil primer and 0.8 mil finish). Oven cure prime coat prior to finish coat application.
   2. Provide finish coat containing not less than 70% Kynar 500 or Hylar 5000 resin, factory applied and oven-cured, per specifications and requirements of Kynar or Hylar basic resin manufacturer and coating manufacturer.
      a. Akzo Coatings Trinar
      b. Valspar Fluropon
      c. PPG Duranar
   3. Finish Color:
      a. Finish color to match existing building siding color, per approved samples.
   4. *Polyvinylidene Fluoride Finish Performance Requirements [T]:* Finish shall meet the following performance requirements.
      a. Gloss: Per ASTM D 523; 20 to 30 on 60 degree gloss meter.
      b. Abrasion Resistance: Per ASTM D 968 with falling sand; coefficient of abrasion average of 70.
      c. Adhesion: Per ASTM D3359; no finish removal after 1/16 inch cross-hatching to bare metal, impacting to point of metal rupture, and subjecting to application and quick removal of cellophane tape.
      d. Salt Spray Test: Per ASTM B 117 for 1000 hours; with non or few No. 8 blisters in field and no more than 1/8" creep corrosion.
      e. Humidity Test: Per ASTM D 2247 at 100% humidity for 1000 hours; no softening or color change, and no blisters.
      f. Impact Test: Per ASTM D 2794 Gardner Impact tester when subjected to 160 in./lbs. and 9/16 inch ball; no loss of adhesion.
      g. Color Retention: Per ASTM D2244; maximum of 5 units change.
      h. Chalk Resistance: Per ASTM D659; minimum rating of 8.

2.4 CLOSURES, FLASHING AND TRIM

A. Closures
   1. Closure Strips: Per materials specified in item 2.5.H, provide flexible premolded to fit profile of siding sheet, to seal off voids between siding and adjacent construction, for installation in concealed locations such as at top and bottom ends of siding sheets where shown and where required for weather tightness.
   2. Metal Closure Strips: Provide fabricated to profile of siding sheet, to seal off voids between siding and adjacent construction where rubber type closure strips cannot be used. Fabricate of same metal, gage and finish as exterior siding sheets.

B. Flashings And Trim
   1. *Metal Flashing and Trim Members [D]:* Fabricate of same metal, gage and finish as exterior siding sheets. Provide members in minimum 10 foot lengths, with lapped and sealed weathertight expansion-contraction connections between lengths. Incorporate drips at lower edge of members exposed to rain run-off. Hem or double-back exposed free edges to engage separate slip-type clips.
   2. Fabricate flashing and trim members to provide a complete neat-appearing finished weathertight installation, including the following:
      a. Trim at external and internal corners of siding.
      b. Trim at top and bottom edges of siding.
      c. Jamb, head, and sill closure trim at all openings such as doors, windows, louvers, etc.
      d. Trim at building wall expansion joints.
      e. Metal copings at roof top edge of siding.
      f. Metal scuppers and trim for same.
      g. Downspouts where shown.
   3. *Flashings, Copings, Scuppers, and Downspouts [D]:* Fabricate items as shown, per applicable requirements of SMACNA "Architectural Sheet Metal Manual", and approved shop drawings.
   4. Provide trim sheets with strippable film on face side.

C. Corners: Corners shall be fabricated from flashing material matching siding and fastened with pop rivets.

2.5 DISSIMILAR MATERIALS ISOLATION

A. Where aluminum comes in contact with other materials and metals, insulate the contact surfaces of aluminum. Use aluminum bituminous coating, brushable non-hardening butyl coating, insulating tape or other system standard with the siding manufacturer and approved by the Owner's Representative.

PART 3 EXECUTION

3.1 INSTALLATION

A. General
1. Field erect this work per approved Shop and Erection Drawings, the published instructions and safety precautions of the manufacturer, as shown, and as specified in this Section.
2. Furnish and install clip angles, clips and similar retainer or fastener items to precast concrete, masonry and structural framing, as required for installation of this work.
3. Erect sheets true and plumb, in alignment with horizontal and vertical edges of the building, and anchor securely in place. Install all work to allow for thermal movement. Protect sheets from damage due to abuse or undue impact; do not install sheets that are bent, dented, chipped and otherwise defective.
4. Where sheets terminate at door frames or other opening frames, provide sheet metal jamb trim. Install sheets with over-lap side joints with lap leeward of the prevailing wind, and with not less than 1 full lap. Install exterior siding with end lap to match offset end lap as standard with the manufacturer, but not less than 2 inches.
5. Install exposed fasteners and perform button-punching to produce, neat, straight horizontal rows of uniformly spaced fasteners. Use concealed fasteners where possible; limit exposed fasteners to approved locations.
6. Welding of metal panel siding to wall framing in not permitted.

B. Insulated Metal Siding
1. Fasten interior liner panels at not over 12 inches O.C. to exterior side of structural supports, with flat face against supports, per manufacturer's printed directions. Butt ends of sheets together.
   a. At interlocking side joints: Force male and female edges of adjacent sheets together to provide a tight seal of the factory-installed joint sealing material.
   b. At overlapping side joints: Apply sealant between overlaps of adjacent sheets to provide a tight seal.
2. Install sub-girts at siding manufacturer's indicated spacing but at not over 48 inches o.c. Secure subgirts to legs of interior liner sheet with siding manufacturer's recommended fastening system. If fasteners are exposed on the interior of the building, cap with caps of color to match color of interior liner sheet.
3. Fasten the exterior sheets to subgirts at spacing recommended by the siding manufacturer. Provide additional fasteners in side laps to secure adjacent sheets to each other, as recommended by the siding manufacturer but at not over 48 inches o.c. Do not expose fasteners in the interior of the building.
   a. Seal overlap joints with a continuous bead of sealant.
   b. Seal interlocking joints by inserting male rib into female rib to effect a seal of the factory-installed joint sealing material.

C. Closures, Flashing, And Trim
1. Install all closures, flashing and trim as required to produce a neat, finished, weathertight installation. Provide proper sealant-sealed end laps in all long runs to allow for thermal movement and to remain weathertight. Secure all such members per manufacturer's

recommendations, but at minimum 12 inches o.c. Bed exposed flashing and trim, and members subject to rain penetration, in sealant.

a. Copings: Install at top edge of siding as shown. Secure hemmed free edges by hooking over concealed continuous metal cleats. Secure back edge to wall by approved means. Lap and seal all joints.
b. Scuppers: Construct in siding as indicated.
c. Wall Expansion Joints: Install metal trim at joints as required.
d. Downspouts: Install where and as shown; lap joints in direction of flow. Secure downspouts to wall. Seal all joints.

2. Install premolded closures at top and bottom ends of siding materials, at cap flashings, and above sill or ledge flashings to keep building weathertight; and, vermin and insect protected.
3. Set closures in place with a dab of sealant to keep closure from falling out when metal flexes.
4. Remove strippable film from siding as sheets are installed.

3.2 CLEANING AND TOUCH-UP PAINTING

A. Upon completion of siding installation, clean all surfaces of siding so as to be free from mud, dirt, abrasions and other surface blemishes. Re-finish all abraided surfaces to match finish, using materials and methods as recommended by the siding manufacturer and that are fully compatible with the original finish system. Repaired surfaces shall be uniform and free from variations in color and surface texture from that of adjacent, like surfaces. If repaired sheet is not acceptable to Owner's Representative, remove sheet and replace with a new sheet.

END OF SECTION

Revision History	
Date	**Rev. No.**
04-08-09	0

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SECTION 16350A

SHORT-CIRCUIT/COORDINATION/ARC FLASH STUDY

PART 1 - GENERAL

1.1 RELATED WORK

A. Section 16010 - General Electrical Requirements

B. Section 16025 – Electrical Systems

C. Section 16050 – Basic Materials and Methods

D. Section 16100 – Motor Control

E. Section 16312 – Load Center Unit Substation- Double Ended

F. Section 16316 – Medium Voltage Metal Clad Switchgear

G. Section16318 - Medium Voltage Metal Enclosed Switchgear

H. Section 16320 – Power Transformer

I. Section 16400 – Distribution Equipment

1.2 REFERENCE

A. The Work under this Section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 1 General Requirements.

1.3 DESCRIPTION OF WORK

Short circuit, protective device coordination, and arc flash studies have been performed for equipment utilizing SKM System Analysis Power Tools for Windows software. In general, equipment and protective devices have been selected and analyzed to minimize arc flash incident energies. Protective device setting tables and single line diagrams with arc flash results are included at the end of this section. Additional report information and electronic files are available for Contractor's use.

A. The study has been performed using acceptable manufacturers from individual specification sections. Equipment and protective device settings have been selected to reduce arc flash energies below 8 cal./cm2 whenever possible.

B. Alternate approved manufacturers are acceptable. Equipment will be evaluated during shop drawing submission and review. Equipment which would cause arc flash energies to increase above 8 cal./cm2 will be cause for rejection.

C. Equipment suppliers may perform independent studies to verify performance of proposed devices. Studies must be performed using "SKM System Analysis, Inc.," Power Tools Electrical Engineering Software.

D. Contractor must submit as-built system data for inclusion in a final study report prior to equipment startup.

E. Contractor shall install arc flash PPE labels prior to startup. BNL standard labels will be provided for Contractor's use.

1.4 REFERENCE STANDARDS

A. BNL SBMS Subject Area: Electrical Safety (Section 5, Design and Installation of Electrical Equipment)

B. IEEE 141 - Recommended Practice for Electric Power Distribution and coordination of Industrial and Commercial Power Systems.

C. IEEE 241 - Recommended Practice for Electric Power Systems in Commercial Buildings.

D. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

E. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis.

F. IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

G. ANSI C37.13 - Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures.

H. ANSI C57.12.00 - Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.

I. NFPA-70E – Standard for Electrical Safety in the Workplace

J. IEEE 1584 – Guide for Performing Arc Flash Hazard Calculations

1.5 SUBMITTALS

A. Submit equipment data in accordance with referenced specification sections. Owner will evaluate proposed submissions utilizing the SKM computer model.

B. If elected, submit independent SKM model of proposed equipment for Owner's approval.

C. Preliminary short-circuit and protective device coordination studies are required to evaluate the submission of distribution equipment shop drawings.

1. The drawings and specifications indicate the general requirements for the electrical equipment being provided. Upgrade and modification to equipment characteristics and ratings will be finalized by the results of the short circuit and protective device coordination studies at no additional cost to the owner. Field settings of devices and adjustments to the new equipment to accomplish conformance with the accepted short circuit and protective device coordination studies shall be carried out by the contractor at no additional cost to the owner. Any proposed deviations from the system indicated on drawings and in specifications shall include demonstration of short circuit and breaker coordination.

2. Short circuit study shall be approved prior to manufacture of equipment.

3. Coordination and arc flash studies shall be approved prior to energizing equipment.

4. Arc flash labeling shall be installed prior to energizing equipment.

D. Submit as built one line diagrams to reflect approved shop drawings, actual cable lengths, breaker settings, and any other approved field changes.

E. Final short-circuit, protective device coordination studies, and arc flash analysis shall be issued after equipment is installed but before it is energized.

F. Final report shall include:

1. One-line diagram.
2. Descriptions and scope of the study.
3. Tabulations of circuit breaker fuse and other protective device ratings versus calculated short circuit duties.
4. Time versus current coordination curves, tabulations of circuit breaker trip unit settings and fuse selection.
5. Fault current calculations.
6. Recommendations.
7. Three phase arcing current ratings for each piece of electrical equipment indicated on one-line diagram.
8. Required PPE (Personal Protective Equipment) level labels for each piece of electrical equipment (medium voltage switches, substations, switchboards, switchgear, motor control centers, distribution panels, panelboards, UPS and downstream panels, Inverters and down stream panels, remote motor controllers, enclosed switches, etc.)

G. If Contractor has prepared all studies, submit all electronic files associated with short circuit, coordination and arc flash studies to allow review and future use of the files. Provide (2) copies on CD and (2) hard copies in binders. Files shall be complete to allow exact regeneration of all studies.

H. If Owner completes studies, Contractor will be provided with (1) hard copy of the one line drawing containing all final arc flash results.

1.6 QUALIFICATIONS

A. Electrical analysis has been performed by Owner or his designated representative.

B. If elected, short circuit, coordination studies, and arc flash analysis may be conducted by the Contractor under the supervision and approval of a Registered Professional Electrical Engineer.

PART 2 - PRODUCTS

2.1 (Not applicable)

PART 3 - EXECUTION

3.1 SHORT CIRCUIT STUDY

A. Entire electrical system including lighting and appliance panelboards and all upstream equipment (automatic transfer switches, remote motor controllers, enclosed switches, etc.) shall be modeled to facilitate the arc flash study as required below.

B. Use typical conductor impedances.

C. Transformer design impedances shall be used when test impedances are not available.

D. Provide:
1. Calculation methods and assumptions.
2. Selected base per unit quantities.
3. One-line diagram.
4. Source impedance data, including utility system and motor fault contribution characteristics.
5. Typical calculations.
6. Tabulations of calculated quantities.
7. Results, conclusions, and recommendations.

E. Calculate short circuit momentary and interrupting duties for a three phase bolted fault at:
   1. Utility's supply termination point.
   2. Branch circuit panelboards, if above 10,000 AIC.
   3. Enclosed Switches

F. Protective Device Evaluation:
   1. Evaluate equipment and protective devices and compare to short circuit ratings.

3.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Entire electrical system including lighting and appliance panelboards and all upstream equipment (automatic transfer switches, remote motor controllers, enclosed switches, etc.) shall be modeled to facilitate the arc flash study as required below.

B. Time-current curves shall be displayed on log-log scale paper.

C. Include on each curve sheet a title and legend, identifying portion of the system covered.

D. Identify device by manufacturer type, function and tap, time delay, and instantaneous settings recommended.

E. Selective Coordination
   1. All circuit breakers associated with the fire pump, elevator, and emergency lighting shall be selectively coordinated per the National Electric Code NEC 2005.

F. Plot characteristics where applicable:
   1. Electric utility's protective device.
   2. Low voltage fuses including minimum melt, total clearing and damage bands.
   3. Low voltage circuit breaker trip devices.
   4. Transformer full-load current, magnetizing inrush current, and ANSI transformer withstand parameters.
   5. Conductor damage curves.
   6. Ground fault protective devices.
   7. Motor starting characteristics and motor damage points.
   8. Generator short circuit decrement curve and generator damage point.
   9. All CT ratios.

3.3 ARC FLASH POTENTIAL STUDY

A. Arc flash potential study shall be performed after short circuit and protective device coordination studies have been completed.

B. Three phase arcing currents for each piece of electrical equipment shall be indicated on a one line diagram of the entire electrical system including 208Y/120V panelboards and all upstream equipment.

C. Calculations shall be performed using an iterative process.

   1. Study shall include calculations for minimum flash protection boundary (measured in meters and feet), incident energy at working distance of 18" (measured in cal/cm^2), required PPE level, limited approach, restricted approach and prohibited approach boundaries (measured in meters and feet).
   2. Calculations shall be performed using both NFPA 70E and IEEE 1584 methods for each piece of equipment. Worst case calculation for each piece of equipment shall be used for report.

a. Minimum Flash Protection Boundary shall be 4'-0" even if calculated to be less.
b. Assume maximum arc duration to be 2 seconds.
c. Do not exclude equipment below 240V fed from transformers rated 125kVA or below. BNL requirements exceed those outlined in NFPA 70E and IEEE 1584

3. Pieces of equipment that will require PPE greater than level 1 shall be investigated.
   a. Investigation shall include adjustment of upstream breaker settings to determine if required PPE level can be reduced with minimal compromise to breaker coordination with other upstream breakers.
   b. Investigation shall continue until lowest PPE level for each piece of electrical equipment can be reached with minimal impact to breaker coordination.
   c. Compromises to breaker coordination as a result of lowering the required PPE level shall be listed and documented for review by Architect/Engineer.

3.4 FINAL REPORTS

A. One Line Diagram

B. Input Data:
   1. Cable and conduit materials.
   2. Transformers.
   3. Circuit resistance and reactive values.

C. Short Circuit Data:
   1. Source fault impedance.
   2. Generator contributions.
   3. X to R ratios.
   4. Asymmetry factors.
   5. Motor contributions.
   6. Short circuit kVA.
   7. Symmetrical and asymmetrical fault currents.

D. Recommended Protective Device Settings:
   1. Circuit Breakers:
      a. Adjustable pickups and time delays (long time, short time, ground).
      b. Adjustable time-current characteristic.
      c. Adjustable instantaneous pickup.
   2. Phase and Ground Relays:
      a. Current setting.
      b. Time setting.
      c. Instantaneous setting.
      d. Specialty non-overcurrent device settings (ex. Relay 27/47, 81 O/U, 25, etc.).
   3. Fuses:
      a. Types
      b. Rating

E. Arc Flash Potential Study Data

1. Calculated three phase arcing currents for all electrical equipment.
2. PPE rating for all electrical equipment.
3. BNL standard PPE labels will be provided by BNL and installed by Contractor.
4. Compromises to breaker coordination resulting from lowering of PPE value at a particular piece of electrical equipment.

3.5 FIELD ADJUSTMENT

A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study.

B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Owner in writing of any required major equipment modifications.

3.6 INSTALLATION

A. Install BNL standard PPE labels on each piece of equipment prior to energizing equipment.

B. PPE label shall be clearly visible upon approach to equipment.

C. For large pieces of equipment, label shall be placed near main overcurrent device or incoming feeder to equipment.

D. Label shall be mounted at a minimum of 42" to bottom and maximum of 66" to top above finished floor.

E. Laminate final one line diagram and mount within the facility where directed by Owner.

END OF SECTION

High Voltage Fuses

Prot Dev	Func Name	Connected Bus	Voltage	Manufacturer	Type	Description	Cartridge	Cartridge Size	Trip
SUB 600B 2B	Phase	SUB 600B S	13,800	S&C	SM-5, 14.4kV	3E- 2-400E Standard Speed	SM-5, 400E	400	400
SUB 600B 5B	Phase	SUB 600B N	13,800	S&C	SM-5, 14.4kV	3E- 2-400E Standard Speed	SM-5, 400E	400	400
SWGR-600-2 1	Phase	SWGR-600-2	4,160	CUTLER-HAMMER	CLS-1, -2, -22,	2R-26R	CLS, 12R	230	230
SWGR-600-2 1	Phase	SWGR-600-2	4,160	CUTLER-HAMMER	CLS-1, -2, -22,	2R-26R	CLS, 12R	230	230
SWGR-600-2 1	Phase	SWGR-600-2	4,160	CUTLER-HAMMER	CLS-1, -2, -22,	2R-26R	CLS, 12R	230	230
SWGR-600-2 1	Phase	SWGR-600-2	4,160	CUTLER-HAMMER	CLS-1, -2, -22,	2R-26R	CLS, 12R	230	230
SWGR-600-2 1	Phase	SWGR-600-2	4,160	CUTLER-HAMMER	CLS-1, -2, -22,	2R-26R	CLS, 12R	230	230
SWGR-600-2 1	Phase	SWGR-600-2	4,160	CUTLER-HAMMER	CLS-1, -2, -22,	2R-26R	CLS, 12R	230	230

Electronic Relays

Prot Dev	Func Name	Connected Bus	Manufacturer	Class Desc.	CT Ratio	Segments				
600-TRNF-51	Ground		GE	745	200 : 5	W1 Ground OC PU	Definite Time 4.00			
600-TRNF-51	Ground		GE	745	200 : 5	W1 Ground OC PU	Definite Time 4.00			
SWGR-600-2 !	Phase	SWGR-600-2	C-H	Digitrip MV	500 : 5	LTPU 1.0	LTD, I2t 6.0	STPU 2.25	STD 0.2	INST 17.5
SWGR-600-2 !	Phase	SWGR-600-2	C-H	Digitrip MV	500 : 5	LTPU 1.0	LTD, I2t 6.0	STPU 2.25	STD 0.2	INST 17.5
SWGR-600-2 !	Ground	SWGR-600-2	C-H	Digitrip MV	50 : 5	GF LTPU 0.1	GF LTD, Flat 0.2	GF STPU 0.1	GF STD 0.05	GF INST 0.5
SWGR-600-2 !	Ground	SWGR-600-2	C-H	Digitrip MV	50 : 5	GF LTPU 0.1	GF LTD, Flat 0.2	GF STPU 0.1	GF STD 0.05	GF INST 0.5
SWGR-600-2 !	Phase	LS SWGR-600-	GE	750	1,200 : 5	Phase OC PU 1	Ext Inverse 2.00	Phase Inst OC PU	Phase Inst OC Delay	
SWGR-600-2 !	Phase	LS SWGR-600-	GE	750	1,200 : 5	Phase OC PU 1	Ext Inverse 2.00	Phase Inst OC PU	Phase Inst OC Delay	
SWGR-600-2 !	Neutral		GE	750	1,200 : 5	Neutral OC PU 0.16	Definite Time 2.00			
SWGR-600-2 !	Neutral		GE	750	1,200 : 5	Neutral OC PU 0.16	Definite Time 2.00			

Static Motor Relays

Prot Dev	Func Name	Connected Bus	Manufacturer	Class Desc.	CT Ratio	FLA	Segments	
SWGR-600-2 :	Ground	SWGR-600-2	GE	469	50 : 5	137	GF PU 0.1	
SWGR-600-2 :	Ground	SWGR-600-2	GE	469	50 : 5	137	GF PU 0.1	
SWGR-600-2 :	Ground	SWGR-600-2	GE	469	50 : 5	137	GF PU 0.1	
SWGR-600-2 :	Ground	SWGR-600-2	GE	469	50 : 5	137	GF PU 0.1	
SWGR-600-2 :	Ground	SWGR-600-2	GE	469	50 : 5	137	GF PU 0.1	
SWGR-600-2 :	Ground	SWGR-600-2	GE	469	50 : 5	137	GF PU 0.1	
SWGR-600-2 :	Phase	SWGR-600-2	GE	469	200 : 5	137	O/L PU 1.15	O/L Curves 5
SWGR-600-2 :	Phase	SWGR-600-2	GE	469	200 : 5	137	O/L PU 1.15	O/L Curves 5
SWGR-600-2 :	Phase	SWGR-600-2	GE	469	200 : 5	137	O/L PU 1.15	O/L Curves 5
SWGR-600-2 :	Phase	SWGR-600-2	GE	469	200 : 5	137	O/L PU 1.15	O/L Curves 5
SWGR-600-2 :	Phase	SWGR-600-2	GE	469	200 : 5	137	O/L PU 1.15	O/L Curves 5
SWGR-600-2 :	Phase	SWGR-600-2	GE	469	200 : 5	137	O/L PU 1.15	O/L Curves 5

Project: CCWF II
Central Chilled Water Facil
ADJUSTABLE LOW VOLTAGE CIRCUIT BREAKER SETTINGS

DESIGNATION		FRAME			TRIP UNIT								
								SETTINGS					
Location/Name	Function	AMPS	MFR	TYPE/MODEL	AMPS	Description	TYPE/MODEL	L.T. P.U.	L.D. TIME	S.D. P.U.	S.D. TIME	I2T	INST P.U.
DP-2, DP-2 CB-1	Phase	125	CUTLER-HAMMER	CHKD	125	LSI, 70-400A Fixed Plug	CHKD, RMS 310	Fixed	Fixed	8	200 ms	Out	Fixed
LS SUB-600-2N CB 5-2, SUB-600-2N CB 5-2	Phase	4,000	CUTLER-HAMMER	DSII-840	4,000	LSI, 100-5000A	DSII, Optim 750/1050	1	2	2.3	0.2	Out	12
LS SUB-600-2N CB 5-2, SUB-600-2N CB 5-2	Ground	4,000	CUTLER-HAMMER	DSII-840	4,000	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.2			Out	
LS SUB-600-2S CB 1-2, SUB-600-2S CB 1-2	Phase	4,000	CUTLER-HAMMER	DSII-840	4,000	LSI, 100-5000A	DSII, Optim 750/1050	1	2	2.3	0.2	Out	12
LS SUB-600-2S CB 1-2, SUB-600-2S CB 1-2	Ground	4,000	CUTLER-HAMMER	DSII-840	4,000	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.2			Out	
SUB-600-2N, SUB-600-2N CB 4-1	Phase	1,600	CUTLER-HAMMER	DSII-616	1,600	LSI, 100-5000A	DSII, Optim 750/1050	1	11	5	0.1	Out	12
SUB-600-2N, SUB-600-2N CB 4-1	Ground	1,600	CUTLER-HAMMER	DSII-616	1,600	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.1			Out	
SUB-600-2N, SUB-600-2N CB 4-2	Phase	1,600	CUTLER-HAMMER	DSII-616	1,600	LSI, 100-5000A	DSII, Optim 750/1050	1	11	5	0.1	Out	12
SUB-600-2N, SUB-600-2N CB 4-2	Ground	1,600	CUTLER-HAMMER	DSII-616	1,600	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.1			Out	
SUB-600-2N, SUB-600-2N CB 4-3	Phase	1,600	CUTLER-HAMMER	DSII-616	1,600	LSI, 100-5000A	DSII, Optim 750/1050	1	3	4	0.1	Out	12
SUB-600-2N, SUB-600-2N CB 4-3	Ground	1,600	CUTLER-HAMMER	DSII-616	1,600	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.1			Out	
SUB-600-2N, SUB-600-2N CB 4-4	Phase	1,600	CUTLER-HAMMER	DSII-616	1,600	LSI, 100-5000A	DSII, Optim 750/1050	1	4	4	0.1	Out	12
SUB-600-2N, SUB-600-2N CB 4-4	Ground	1,600	CUTLER-HAMMER	DSII-616	1,600	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.1			Out	
SUB-600-2N, SUB-600-2N CB 5-3	Phase	1,600	CUTLER-HAMMER	DSII-616	1,600	LSI, 100-5000A	DSII, Optim 750/1050	1	4	4	0.1	Out	12
SUB-600-2N, SUB-600-2N CB 5-3	Ground	1,600	CUTLER-HAMMER	DSII-616	1,600	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.1			Out	
SUB-600-2S, SUB-600-2S CB 1-3	Phase	1,600	CUTLER-HAMMER	DSII-616	800	LSI, 100-5000A	DSII, Optim 750/1050	1	2	4	0.1	Out	12
SUB-600-2S, SUB-600-2S CB 1-3	Ground	1,600	CUTLER-HAMMER	DSII-616	800	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.1			Out	
SUB-600-2S, SUB-600-2S CB 2-1	Phase	1,600	CUTLER-HAMMER	DSII-616	1,600	LSI, 100-5000A	DSII, Optim 750/1050	1	2	2.5	0.1	Out	12
SUB-600-2S, SUB-600-2S CB 2-1	Ground	1,600	CUTLER-HAMMER	DSII-616	1,600	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.1			Out	
SUB-600-2S, SUB-600-2S CB 2-2	Phase	1,600	CUTLER-HAMMER	DSII-616	1,600	LSI, 100-5000A	DSII, Optim 750/1050	1	2	3	0.1	Out	12
SUB-600-2S, SUB-600-2S CB 2-2	Ground	1,600	CUTLER-HAMMER	DSII-616	1,600	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.1			Out	

DESIGNATION		FRAME			TRIP UNIT								
								SETTINGS					
Location/Name	Function	AMPS	MFR	TYPE/MODEL	AMPS	Description	TYPE/MODEL	L.T. P.U.	L.D. TIME	S.D. P.U.	S.D. TIME	I2T	INST P.U.
SUB-600-2S, SUB-600-2S CB 2-3	Phase	1,600	CUTLER-HAMMER	DSII-616	1,600	LSI, 100-5000A	DSII, Optim 750/1050	1	3	4	0.1	Out	12
SUB-600-2S, SUB-600-2S CB 2-3	Ground	1,600	CUTLER-HAMMER	DSII-616	1,600	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.1			Out	
SUB-600-2S, SUB-600-2S CB 2-4	Phase	1,600	CUTLER-HAMMER	DSII-616	1,600	LSI, 100-5000A	DSII, Optim 750/1050	1	9	5	0.1	Out	12
SUB-600-2S, SUB-600-2S CB 2-4	Ground	1,600	CUTLER-HAMMER	DSII-616	1,600	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.1			Out	
SUB-600-2S, SUB-600-2S CB 3-2	Phase	4,000	CUTLER-HAMMER	DSII-840	4,000	LSI, 100-5000A	DSII, Optim 750/1050	0.80	2	2.5	0.2	Out	12
SUB-600-2S, SUB-600-2S CB 3-2	Ground	4,000	CUTLER-HAMMER	DSII-840	4,000	GF, 200-5000A	DSII, Optim 750/1050	0.25	0.2			Out	

Thermal Magnetic Molded Cases

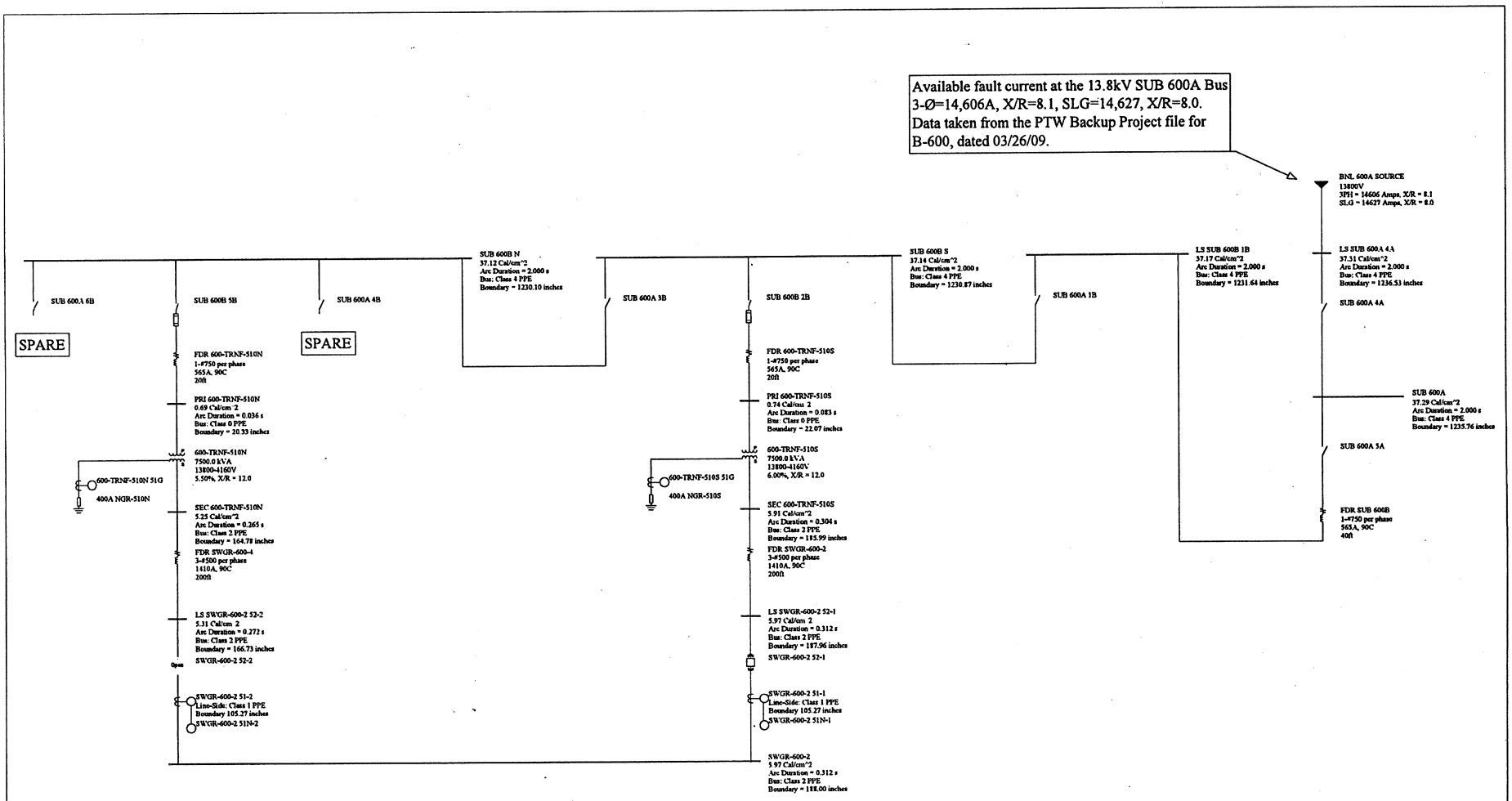
Prot Dev	Func Name	Connected Bus	Voltage	Manufacturer	Type	Frame Desc.	Frame	Sensor	Segments
DP-2 CB-2	Phase	DP-2	480	CUTLER-HAMMER	HFD	HFD	100	100	Fixed 0.00
DP-2 CB-3	Phase	DP-2	480	CUTLER-HAMMER	HFD	HFD	100	100	Fixed 0.00
DP-2 CB-6	Phase	DP-2	480	CUTLER-HAMMER	HFD	HFD	25	25	Fixed 0.00
DP-2 CB-7	Phase	DP-2	480	CUTLER-HAMMER	HFD	HFD	15	15	Fixed 0.00
DP-3 CB-4	Phase	DP-3	480	CUTLER-HAMMER	HFD	HFD	20	20	Fixed 0.00
DP-3 MCB	Phase	LS DP-3 MCB	480	CUTLER-HAMMER	HFD	HFD	200	200	Fixed 0.00
LP-2 MCB	Phase	LS LP-2 MCB	480	CUTLER-HAMMER	HFD	HFD	100	100	Fixed 0.00
MLC-2 MCB	Phase	LS MLC-2 MC	208	CUTLER-HAMMER	BAB, 3-Pole	BAB	60	60	Fixed 0.00
RP-4 MCB	Phase	LS RP-4 MCB	208	CUTLER-HAMMER	BAB, 3-Pole	BAB	70	70	Fixed 0.00
RP-5 MCB	Phase	LS RP-5 MCB	208	CUTLER-HAMMER	BAB, 3-Pole	BAB	50	50	Fixed 0.00
RP-6 MCB	Phase	LS RP-6 MCB	208	CUTLER-HAMMER	BAB, 3-Pole	BAB	80	80	Fixed 0.00
RP-U MCB	Phase	LS RP-U MCB	208	CUTLER-HAMMER	BAB, 3-Pole	BAB	100	100	Fixed 0.00

Low Voltage Fuses

Prot Dev	Func Name	Connected Bus	Voltage	Manufacturer	Type	Description	Cartridge	Cartridge Size	Trip
FUSE FDS A	Phase	FDS AD-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	5	5
FUSE FDS E	Phase	FDS EF-10	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	10	10
FUSE FDS E	Phase	FDS EF-6	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
FUSE FDS E	Phase	FDS EF-7	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	18	18
FUSE FDS E	Phase	FDS EF-8	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	18	18
FUSE FDS E	Phase	FDS EF-9	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	10	10
FUSE FDS H	Phase	FDS HWP-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
FUSE FDS M	Phase	FDS MOV 714	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
FUSE FDS M	Phase	FDS MOV 715	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
FUSE FDS M	Phase	FDS MOV 716	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
FUSE FDS M	Phase	FDS MOV 717	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
FUSE FDS M	Phase	FDS MOV 718	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
FUSE FDS M	Phase	FDS MOV 719	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
FUSE FDS R	Phase	FDS RP-6	208	BUSSMANN	FRN-R, 250V Class	1-600A	FRN-R	80	80
FUSE VFD C	Phase	BW-600-4 FDS 1	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	400	400
FUSE VFD C	Phase	BW-600-4 FDS 2	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	400	400
FUSE VFD C	Phase	BW-600-5 FDS 1	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	400	400
FUSE VFD C	Phase	BW-600-5 FDS 2	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	400	400
FUSE VFD C	Phase	BW-600-5 FDS 3	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	400	400
FUSE VFD C	Phase	BW-600-6 FDS 1	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	200	175
FUSE VFD C	Phase	BW-600-6 FDS 2	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	200	175
FUSE VFD C	Phase	BW-600-6 FDS 3	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	200	175
FUSE VFD C	Phase	BW-600-6 FDS 4	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	200	175
FUSE VFD C	Phase	BW-600-6 FDS 5	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	200	175
FUSE VFD C	Phase	BW-600-7 FDS 1	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	200	200
FUSE VFD C	Phase	BW-600-7 FDS 2	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	200	200
FUSE VFD C	Phase	BW-600-7 FDS 3	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	200	200
FUSE VFD C	Phase	BW-600-7 FDS 4	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	200	200
FUSE VFD C	Phase	BW-600-7 FDS 5	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	200	200
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	3	3
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	2	2
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1

Prot Dev	Func Name	Connected Bus	Voltage	Manufacturer	Type	Description	Cartridge	Cartridge Size	Trip
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	10	10
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	15	15
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	18	18
MCC-600-3 F	Phase	MCC-600-3	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	10	10
MCC-600-3 F	Phase	MCC-600-3	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	200	200
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	30	30
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	60	60
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	60	60
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	30	30
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	30	30
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	30	30
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	125	125
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	60	60
MCC-600-4 F	Phase	MCC-600-4	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	400	300
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	18	18
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	60	60
MCC-600-4 F	Phase	MCC-600-4	480	GOULD SHAWMUT	AJT, 600V Class J	15-600A	AJT	400	300
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	30	30
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	30	30
MCC-600-4 F	Phase	MCC-600-4	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	10	10
MCC-600-4 F	Phase	MCC-600-4 FD	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	60	60
MCC-600-4 F	Phase	MCC-600-4 FD	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	60	60
MCC-600-4 F	Phase	MCC-600-4 FD	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	60	60
MCC-600-4 F	Phase	MCC-600-4 FD	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	60	60
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	175	175
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	175	175
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	175	175
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	175	175
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	175	175
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	20	20
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	6	6
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600A-2 1	Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1

Prot Dev	Func Name	Connected Bus	Voltage	Manufacturer	Type	Description	Cartridge	Cartridge Size	Trip
MCC-600A-2	1 Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	20	20
MCC-600A-2	1 Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	60	60
MCC-600A-2	1 Phase	MCC-600A-2	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	1	1
MCC-600A-2	1 Phase	MCC-600A-2 F	480	BUSSMANN	FRS-R, 600V Class	1-600A	FRS-R	60	60
MCC-600A-2	1 Phase	LS MCC-600A-	480	BUSSMANN	KRP-C, 600V Class	601-6000A	KRP-C	800	800



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Arc Flash Results - Base Project
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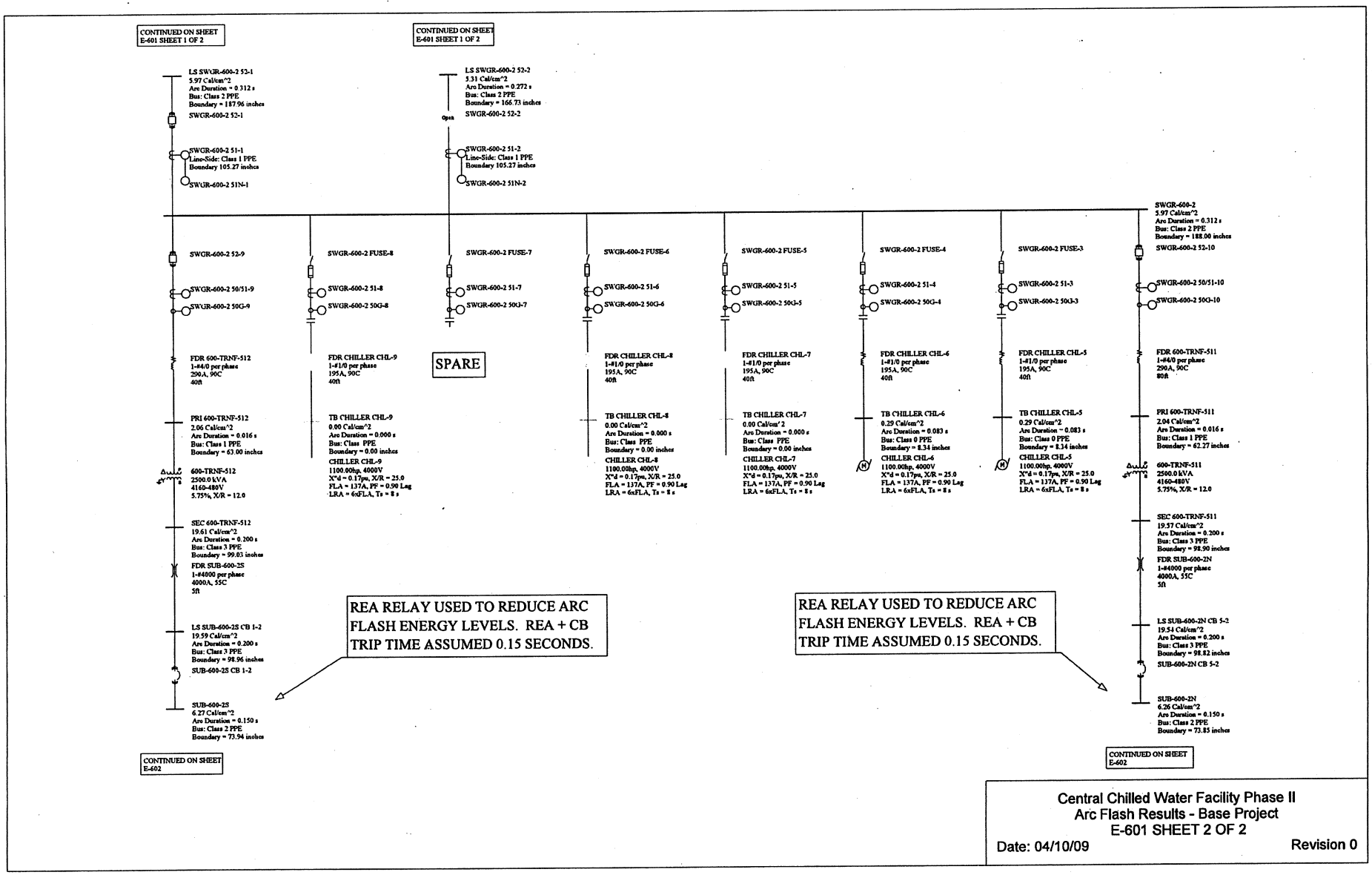

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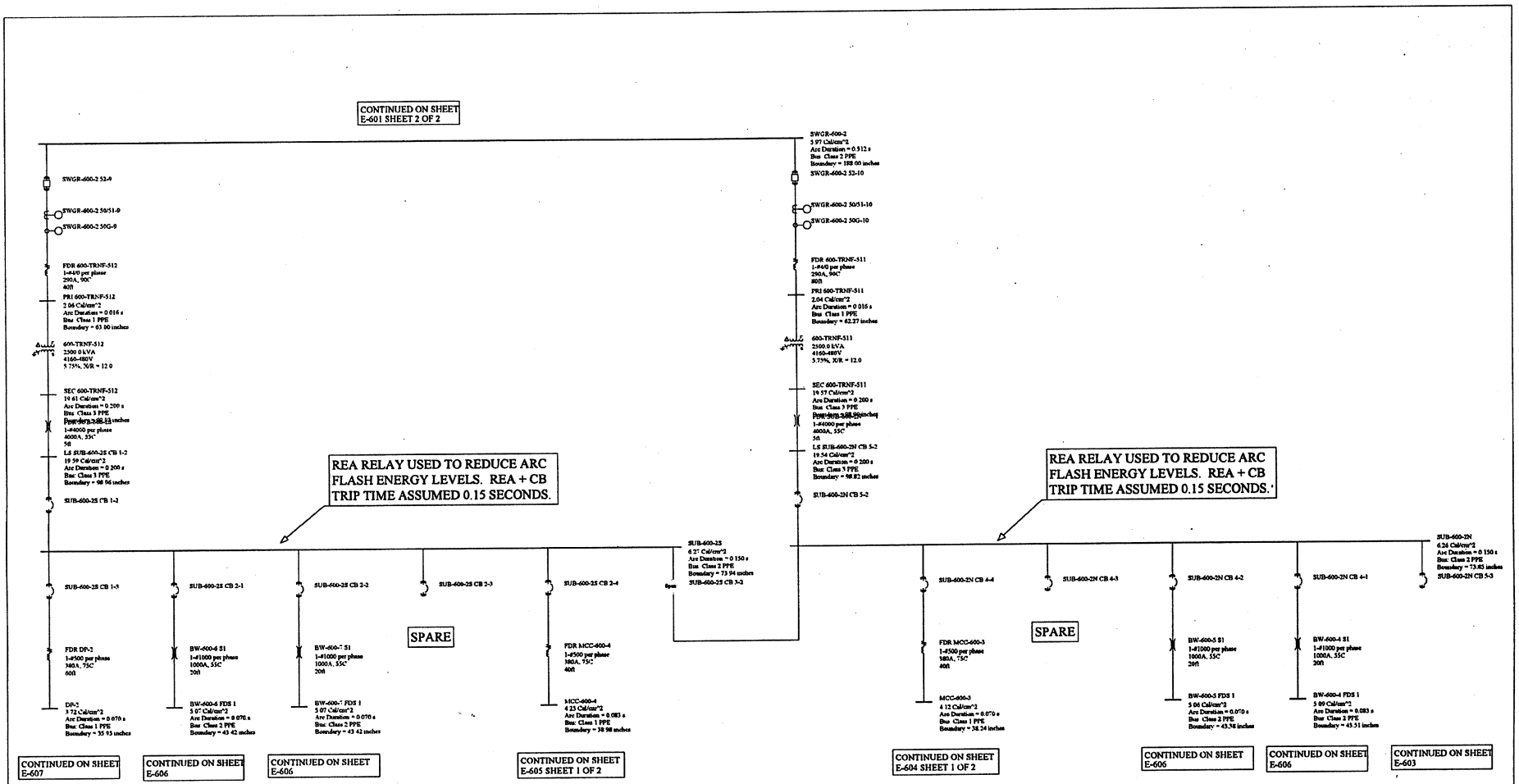
E-601 SHEET 2 OF 2

Date: 04/10/09

Revision 0



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Arc Flash Results - Base Project
E-602

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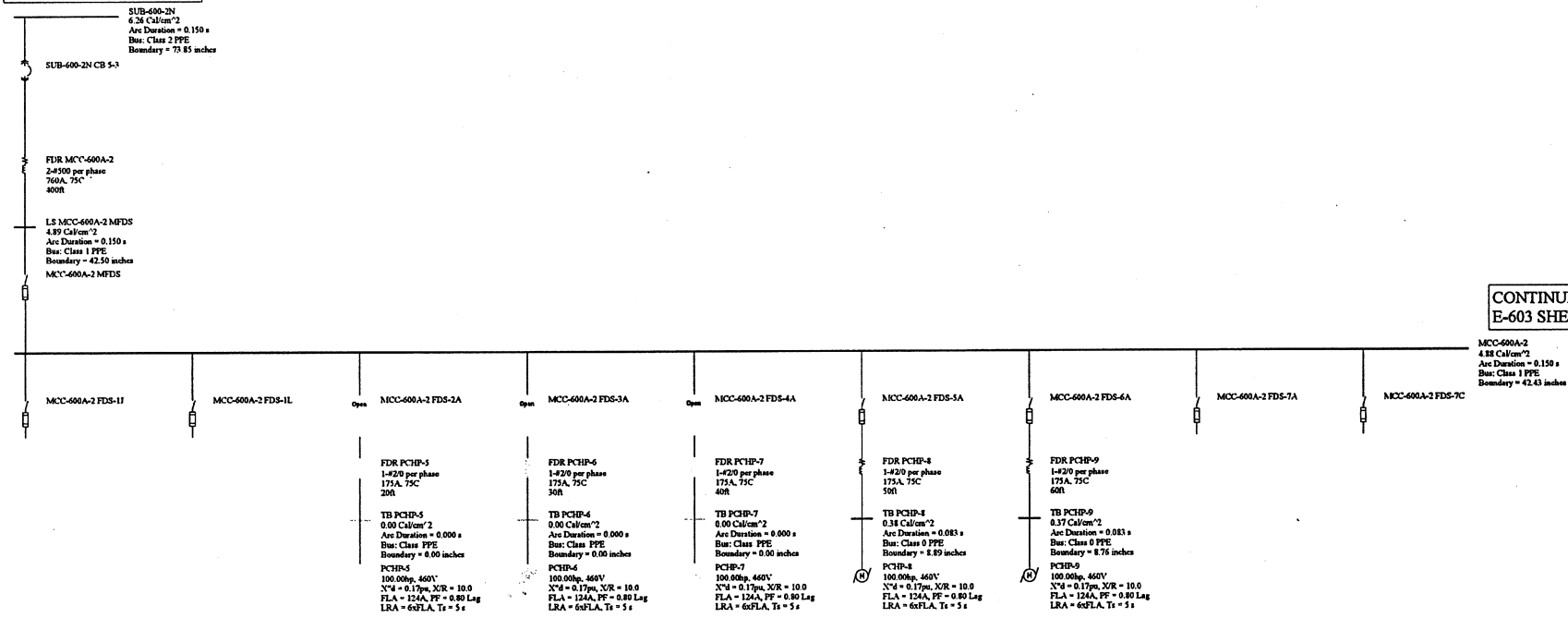

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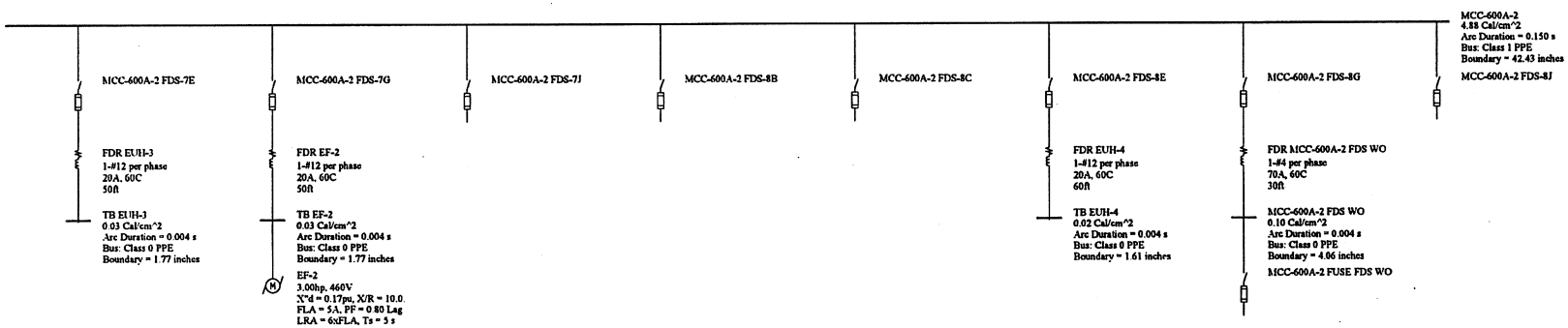

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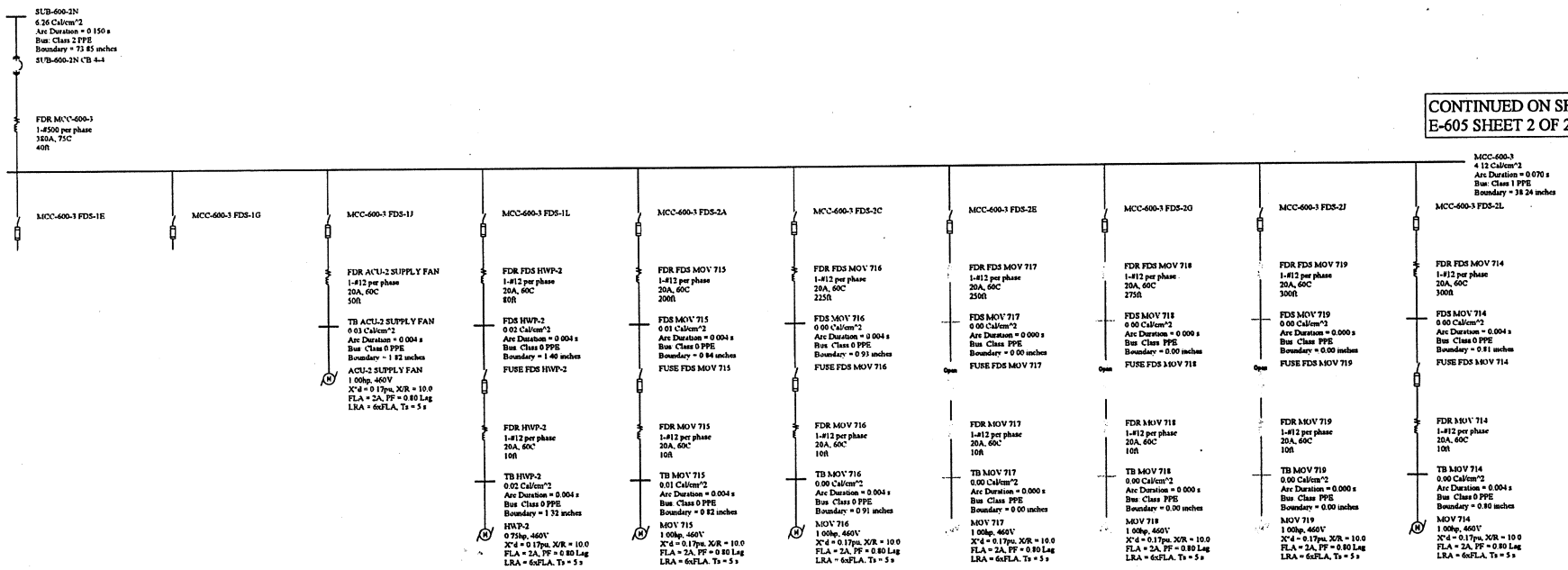
E-602



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E-605 SHEET 2 OF 2

Central Chilled Water Facility Phase II
Arc Flash Results - Base Project
E-604 SHEET 1 OF 2
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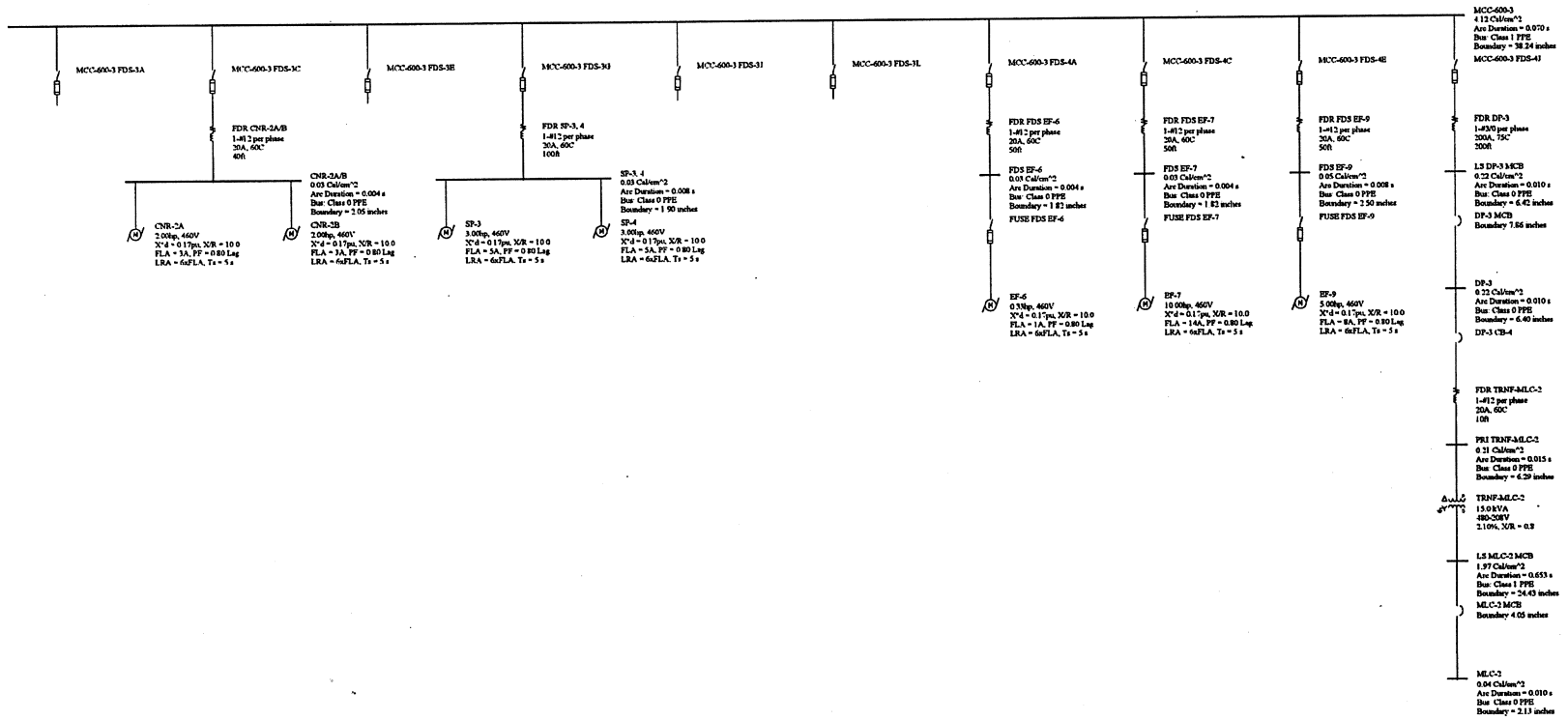
Revision 0

CONTINUED ON SHEET
E-604 SHEET 1 OF 2



Central Chilled Water Facility Phase II
Arc Flash Results - Base Project
E-604 SHEET 2 OF 2

Date: 04/10/09

Revision 0

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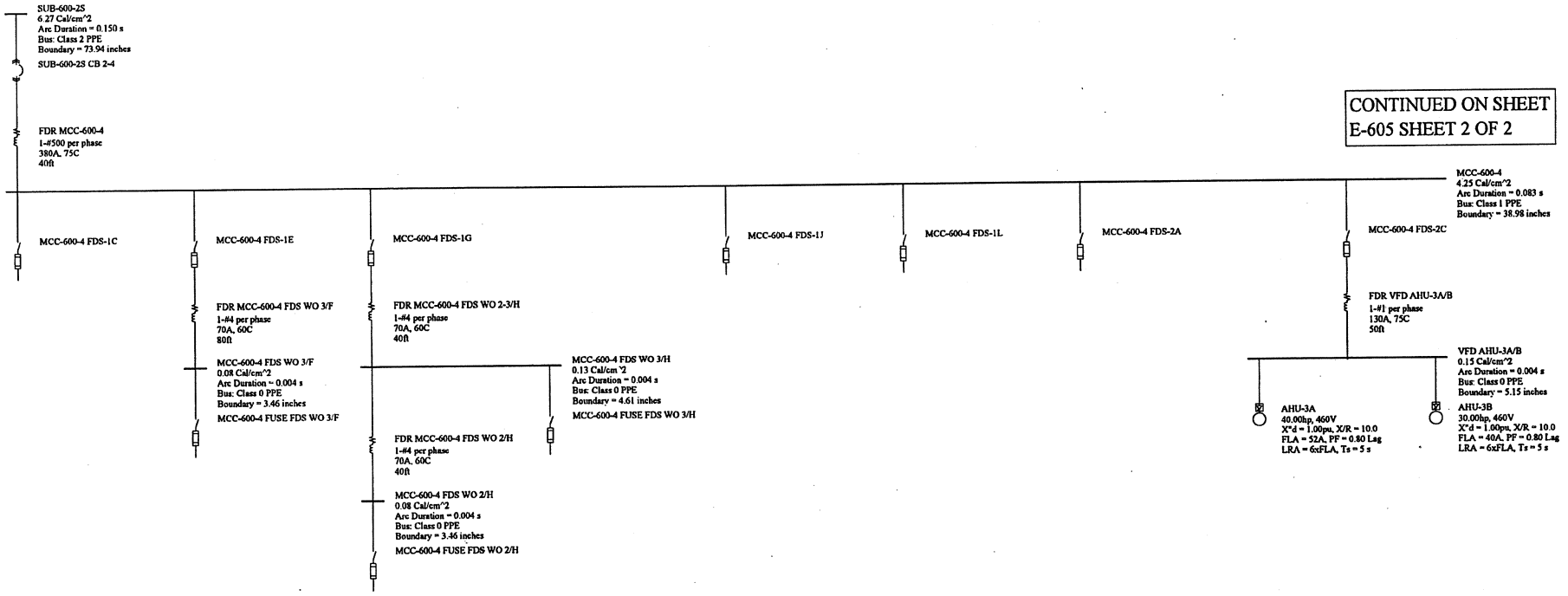

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E-605 SHEET 2 OF 2

Central Chilled Water Facility Phase II
Arc Flash Results - Base Project
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Date: 04/10/09 Revision 0

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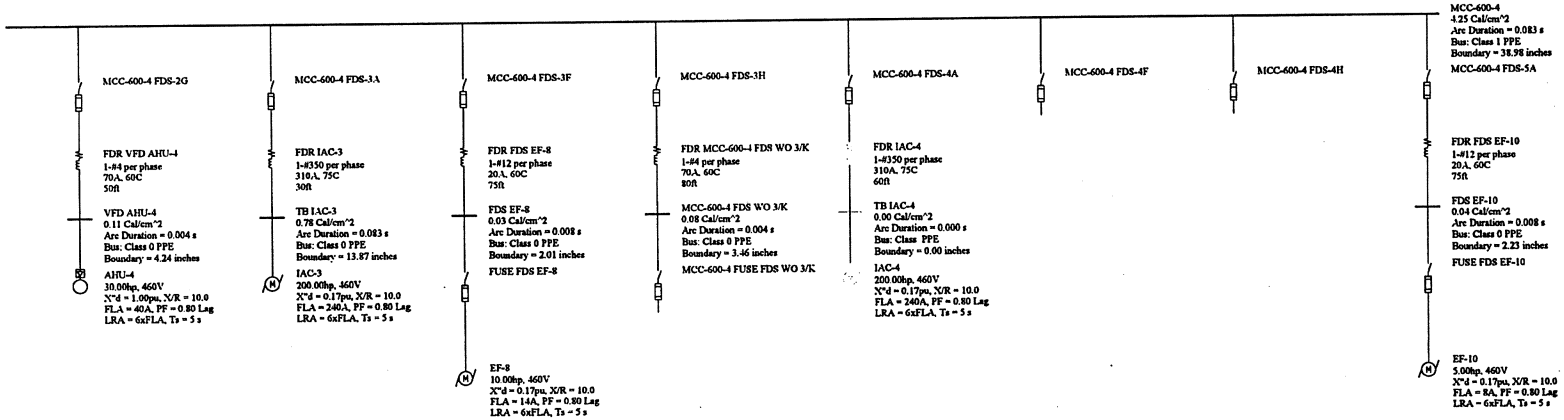
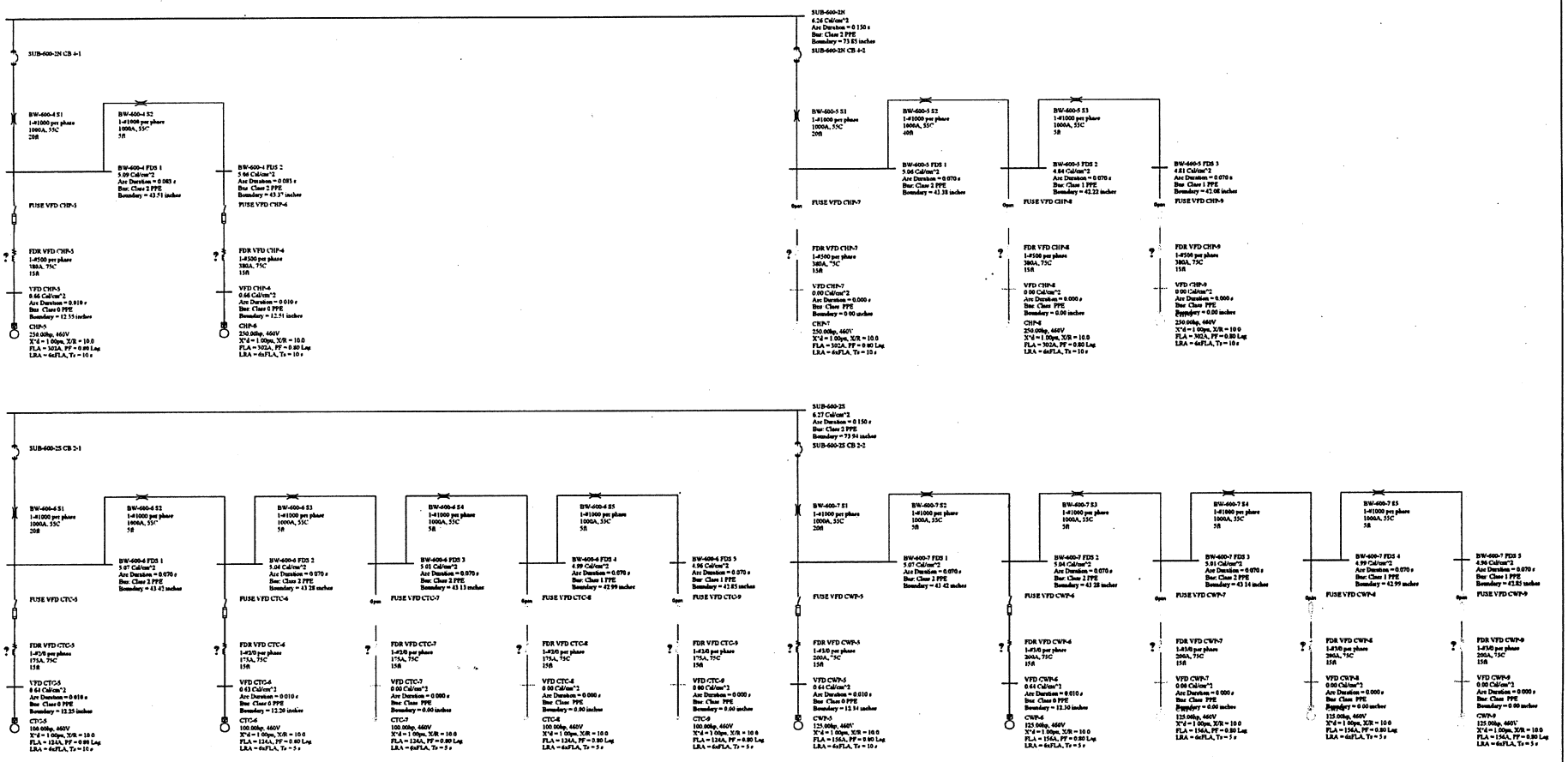
E-605 SHEET 1 OF 2



Central Chilled Water Facility Phase II
Arc Flash Results - Base Project
E-605 SHEET 2 OF 2

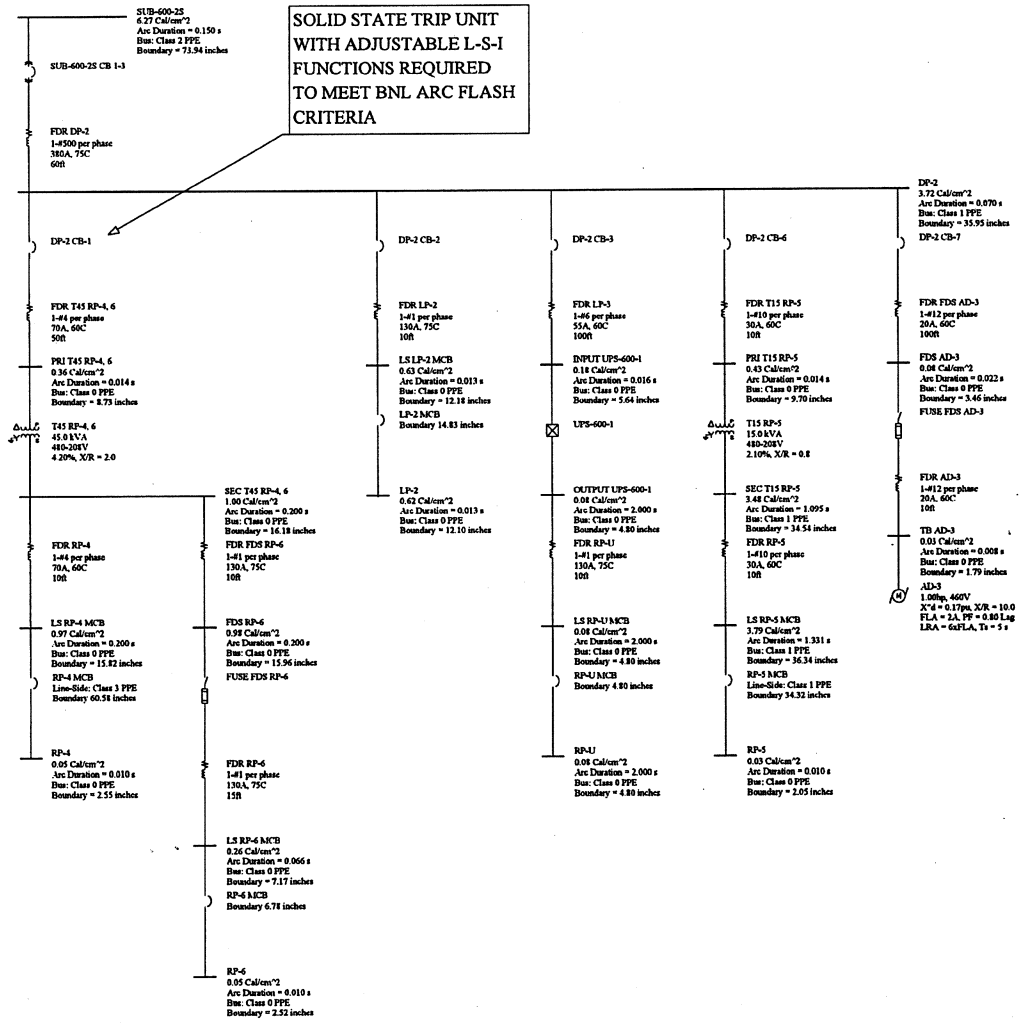
Date: 04/10/09

Revision 0



Central Chilled Water Facility Phase II
Arc Flash Results - Base Project
E-606

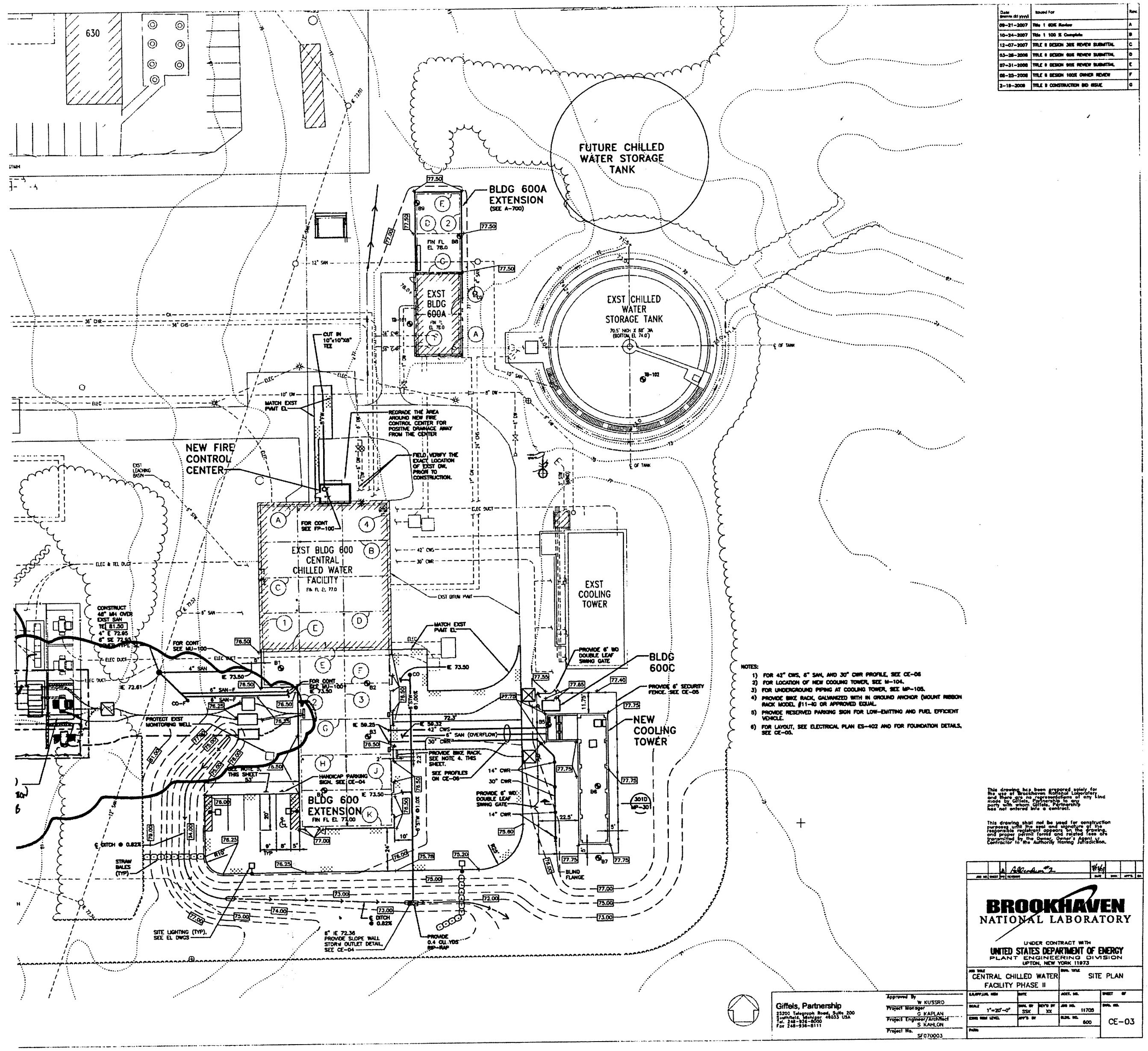
Date: 04/10/09 Revision 0



Central Chilled Water Facility Phase II
Arc Flash Results - Base Project
E-607

Date: 04/10/09 Revision 0

BNL CCWF II
Addendum 2
Revised Drawings



Date (mm dd yyyy)	Issued For	Rev.
09-21-2007	Title 1 60% Review	A
10-24-2007	Title 1 100 % Complete	B
12-07-2007	TITLE II DESIGN 30% REVIEW SUBMITTAL	C
03-28-2008	TITLE II DESIGN 60% REVIEW SUBMITTAL	D
07-31-2008	TITLE II DESIGN 90% REVIEW SUBMITTAL	E
08-25-2008	TITLE II DESIGN 100% OWNER REVIEW	F
2-18-2009	TITLE II CONSTRUCTION BID ISSUE	G